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MAGNETOHYDRODINAMIC NUMERICAL MODELING OF MAGNETISED PLASMAS

TRACK NUMBERS : 500,100, 800

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ABSTRACT

Fusion based on magnetic confinement aims at producing power by using the energy liberated by deuterium and tritium nuclei reacting at extremely high temperatures (10^7 - 10^8 K), thus resulting in a plasma that is confined by magnetic fields in machines of toroidal shape known as tokamaks. Numerous technological and scientific challenges remain, that require a sustained research effort. Foremost among these challenges is the issue of power exhaust. The control of heat fluxes onto the tokamak walls in high energy confinement configurations and for both steady-state and transient regimes must be addressed to successfully run future ITER experiments. The proposal's primary goal is to review advanced numerical tools in finite volume and finite element frameworks, explicitly focusing on highly magnetised plasmas.

1) Consider the divergence-free property of the magnetic field, either by divergence cleaning or the use of the magnetic potential. When using magnetic potential, the C1-regularity of the numerical approximation is often desired.
2) Design well-balanced schemes that can preserve a given equilibrium for a very long time without initial perturbations.
3) Transport models for large scales MHD instabilities as disruptions.
4) Design of Efficient numerical strategies for MHD and reduced-MHD models.

Our interests are modelling and design of accurate and efficient numerical strategies. We review numerical difficulties and highlight some recent axes of improvements.

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